

"E L E N C O"

Single Sideband
Transmitting Equipment
AND
Accessories



Manufactured by
THE
ELECTRONIC ENGINEERING CO.
Wabash, Indiana

400-T Series Single Sideband Transmitters

(400-T3 Illustration on Front Cover)

The 400-T transmitter is a completely self contained 400 watt single sideband transmitter. The 400-T3 covers the 20, 40, and 75 meter bands. The 400-T4 covers 10 or 15, 20, 40, and 75.

The 400-T consists of an SS-75 exciter on the bottom deck of a gray 36 inch deluxe relay rack cabinet, a bandswitching mixer (BSM-3-PR or BSM-4-PR) in the middle deck, and a PA-400 linear amplifier on the top deck. For more information on the individual units, see elsewhere in this catalogue.

The unit is bandswitching except for the final amplifier grid and plate coils, which are plug-in.

Receiver carrier is provided for on all bands covered by the 400-T.

The only tuning adjustments required when changing bands are the PA-400 grid, plate, and antenna circuits. No tuning of the exciter or mixer is necessary. The VFO operates on all bands. The VFO dial provides the same KC per division bandspread on all bands.

The 400-T can be adjusted and loaded with the self contained meters. No additional instruments or meters are required.

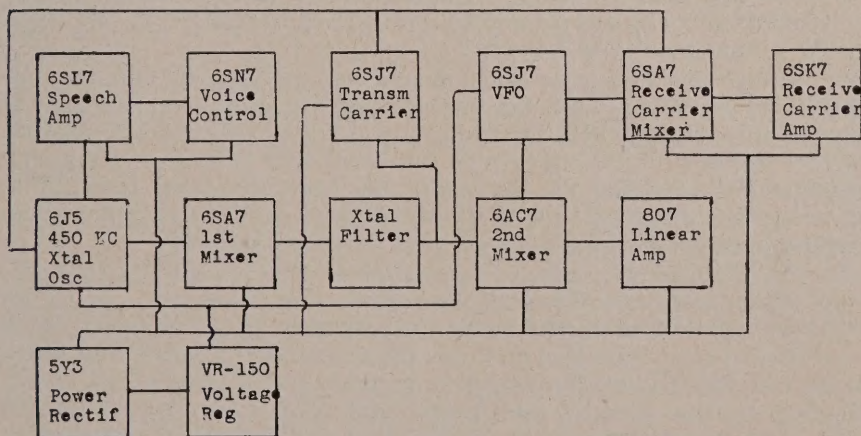
400-T3, completely aligned, with all tubes, cables, coils, and crystals, for 20, 40, 75 meters, \$695.00.

400-T4 completely aligned, with all tubes, cables, coils, crystals for 20, 40 and 75 meters; plus choice of 10 or 15 meter final coils and choice of 10 or 15 meter mixer crystals, \$745.00.

THE SS-75



The SS-75 is a complete 75 meter single sideband transmitter exciter utilizing a twelve tube circuit, illustrated in block diagram form:



The 450 KC lower sideband crystal filter used for single sideband generation is very stable, and in normal use will never require ad-

justment. A 450 KC crystal oscillator, powered from a voltage regulated source, is used to provide a very stable source of carrier to the first mixer stage. This assures placement of the carrier frequency at the optimum point on the skirt of the band pass crystal filter. The 450 KC carrier from the crystal oscillator is injected to the control grid. Audio from the 6SL7 speech amplifier is injected into No. 3 grid. The audio is mixed with the carrier in this tube to produce a double sideband with carrier signal at 450 KC. This signal is then fed through the bandpass crystal filter. The filter greatly attenuates the undesired upper sideband and the carrier; so at the output of the filter, there appears 450 KC SSSC.

In order to arrive at the desired operating frequency of 4 Mc, it is necessary to heterodyne the 450 KC SSSC signal with another source of carrier, so that the sum of the two frequencies add up to 4 Mc. The VFO frequency range is 3350 to 3550 in order to cover 3800 to 4000 KC with the single sideband output from the second mixer.

A 6SJ7 tube is used as a VFO in an E.C.O. circuit. Air trimmers and silver mica padders are used throughout the oscillator circuit, along with very rigid mechanical construction. The result is a VFO that is very stable.

A 6AC7 tube is used as a high gain second mixer to combine the 450 KC SSSC from the filter with the 3550 VFO frequency. The plate circuit of the second mixer is tuned to 4 Mc, as is the grid circuit of the 807. Inductive coupling is used between the plate of the second mixer and the grid of the 807. The plate circuit of the 807 output stage is a high C circuit with unbalanced low impedance variable link output coupling.

The 807, when operated class A with the exciter power supply, will provide 10 watts peak output — enough power to drive most high power tubes to a full KW. A spare wired socket is provided to accommodate another 807. Using two 807s and an external power supply (800 volts Ep, 300 Esg. regulated and minus 35 volts Eg), 100 watts peak output can be obtained.

A 6SJ7 tube is used as a 450 Kc. carrier amplifier. Its output is variable and controlled from the front panel. The output of this tube is mixed with the 3550 KC VFO frequency in the second mixer to provide 4 Mc. carrier for operating single sideband with carrier, or for tuning purposes in adjusting the loading of the linear amplifier. There is no provision for double sideband transmission, in order to keep the transmitted bandwidth of the output signal within 3 KC limits.

The 6SL7 is the audio voltage amplifier. The plate of the first section feeds the No. 3 grid of the first mixer, through a gain control on the front panel. The second section is a voltage amplifier which feeds the 6SN7 gating tube that operates the voice control relay. The threshold control for the voice operated circuit is a screwdriver slot potentiometer on the back of the chassis. The voice controlled channel is entirely independent from the modulating audio channel so that gain adjustments on either channel has no effect on the other channel.

The 6SN7 voice control tube uses one section as a voltage amplifier and the second section as a grounded cathode negative pulsed gating tube. The plate of this section is connected to a plate circuit relay with two sets of double throw contacts. One set of contacts serve to mute the exciter by keying the 6AC7 second mixer, by applying a positive bias to the cathode. The other side of the same set of contacts can be used to mute the receiver. The circuit supplies a positive bias for the RF and IF stage cathodes in the receiver. Many receivers are designed for this type muting circuit. The other set of double throw contacts can be used to control other transmitter or receiver circuits if necessary.

Break-in CW operation is provided for by means of a key jack on the rear of the chassis, and is accomplished by keying the voice control relay.

For receiver carrier injection, a 6SA7 is used as a mixer for the 450 KC crystal oscillator frequency and the 3550 VFO frequency. The plate circuit is tuned to 4 Mc. A 6SK7 is used as a receiver carrier amplifier tube. An impedance matching network is provided in the plate circuit to accommodate various receiver input impedances. The gain of these two stages is cascaded through a common gain control on the front panel of the exciter, providing over 100 db of injected carrier amplitude control.

Output frequency conversion — in order to arrive at the operating frequency of 4 Mc with the single sideband generated at 450 KC, it is necessary to heterodyne the 450 KC SSSC signal with carrier at 3550. By the same token, if 14.3 Mc output is desired from the 4 Mc exciter, it is necessary to heterodyne the 4 Mc SSSC signal to 14.3 Mc by means of a 10.3 Mc crystal oscillator. In this case VFO control over a 200 KC range is provided in the SS-75. So a crystal controlled heterodyne carrier can be used. This will permit very stable VFO operation on 14 Mc. If 10 meter operation is desired, a 24.7 Mc crystal will provide VFO controlled output on that band with the same order of stability that is obtained on 75 meters. It is necessary, of course, to have some power available on the resultant output frequency. 10 to 20 watts is generally sufficient. This amount of power can be furnished by one or two 807 tubes operating as screen modulated mixer stages.

This is the arrangement used in the **Elenco** line of Bandswitching Mixers.

The 10.3 carrier frequency from the crystal oscillator is injected to the control grid of the 807 tube. The screen of the 807 is connected to a parallel tuned circuit adjusted to 4 Mc and link coupled to the exciter output (150 regulated Esg). The plate of the 807 mixer is connected to a parallel tuned circuit adjusted to 14 Mc. This arrangement will provide 10 watts from one 807 with 600V Ep or 20 watts from two 807s in parallel.

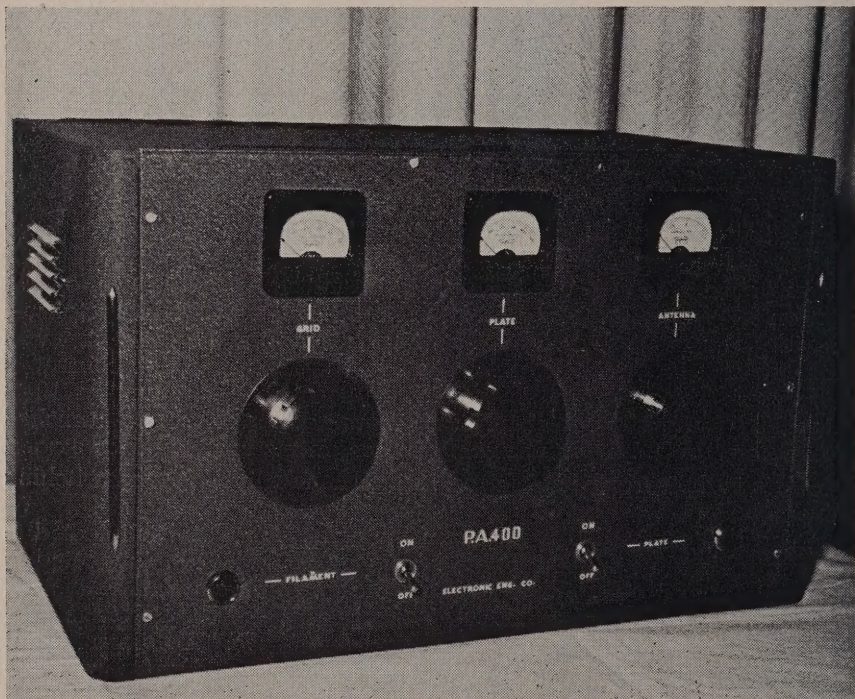
The SS-75, when used with a receiver equipped with a double lattice crystal filter or a mechanical filter, affords excellent single sideband reception, due to the carrier injection from the SS-75 and the

selectivity of the filter. Accurate S meter readings can be taken with this method on SSSC signals. Unwanted sideband observations can be made, simply by rocking the receiver dial from one side of the carrier to the other. When front end carrier injection is used, a SSSC signal tunes just like an AM signal on the receiver dial. The voice does not change pitch. Sideband attenuation readings in db. can be taken directly from the receiver S meter by this method.

PA-400 LINEAR POWER AMPLIFIER

The PA-400 utilizes a pair of 811A zero bias triodes in a cross neutralized push pull circuit.

The power supply is built-in, making the unit completely self contained, in a deluxe, gray ripple, cabinet 12" x 20" x 12". It makes a perfect companion unit for the SS-75 exciter.



The PA-400 is conservatively rated at 400 watts DC input to the 811As.

The RF input and output circuits are designed to work into an unbalanced low impedance line. Variable inductive coupling is provided in both plate and grid circuits, in order to properly adjust the

loading on the input and output circuits. The plate tank link is adjustable from the front panel.

The grid, plate, and antenna circuits are metered; thus the linear can be loaded without need for additional meters or instruments.

High capacity grid and plate circuit tanks are utilized to provide proper "Q".

75 watt plug-in coils are used in the grid circuit, and 500 watt coils are used in the plate circuit.

The PA-400 will operate 10 through 75 meters when using appropriate coils. 75 meter coils are furnished with the unit.

The PA-400 can be driven to full output with any SSB exciter delivering 6 watts or more.

Tube compliment; two 811As, two 866As.

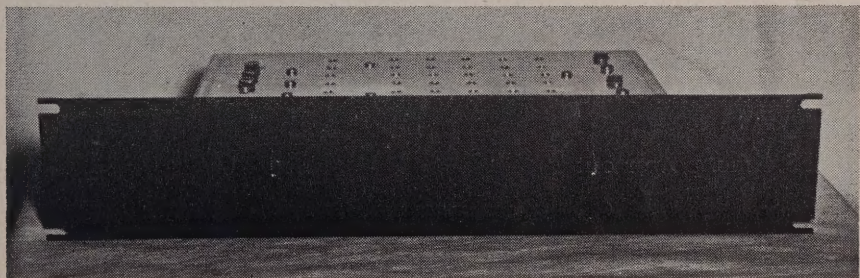
PA-400, complete with 75 meter coils, wired and tested \$265.00; kit \$240.00.

BSM SERIES BANDSWITCHING MIXERS

The bandswitching mixer is used to convert the 4 Mc output frequency of the SS-75 to other bands.

For maximum operating convenience, the units have individual complete pretuned tank circuits for each band. This means that no retuning is required in the exciter or mixer stage when changing bands; similar to changing bands on a receiver, just turn the band-switch.

The BSM units use two 807 tubes as mixers, and a 6AG7 as the heterodyning crystal oscillator.



BSM-3

The power output is 20 watts on 20 and 40 meters, somewhat less on 10 and 15 meters, when using a 600 volt supply.

When using the SS-75 in conjunction with the BSM mixers, the units serve to convert the receiver carrier from the exciter to the desired band, as well as the transmitted SSB signal; thus serving a dual function.

Six models are provided to accommodate most any individual requirement.

On all models, when the bandswitch is on 75 meters, the mixer

power supply is automatically turned off, and the 4 MC. output from the exciter is switched straight through to the final.

All models are priced completely aligned, with all tubes and crystals, choice of black or gray panels or cabinets.

BSM-3 20, 40, 75 meters, less power supply, mounted on 3½" relay rack panel \$75.00

*BSM-4 Same as BSM-3, plus choice of 10 or 15 meter band \$100.00

BSM-3PC 20, 40, 75 meter bands, with built-in power supply, in cabinet 10" x 8" x 7" \$125.00

*BSM-4PC Same as above, plus choice of 10 or 15 meter band \$150.00

BSM-3PR Same as BSM-3PC, except mounted on 10½" rack panel \$125.00

*BSM-4PR Same as BSM-4PC, except mounted on 10½" relay rack panel \$150.00

*Will operate both 10 and 15 meters by using proper crystal.

THE X-4 SSB EXCITER

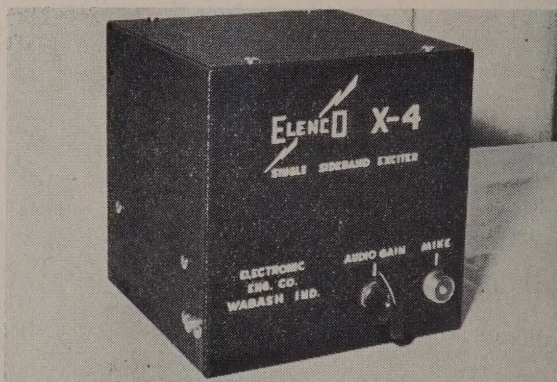
The X-4 exciter features the following tube complement and circuitry:

6SA7 crystal oscillator and audio mixer

6SL7 speech amplifier

6SA7 second mixer and VFO

6F6 4 mc. power output



The X-4 utilizes a very stable crystal filter for sideband generation. The filter is similar to the one used in the SS-75 exciter.

Provision is made for crystal or VFO operation of the unit.

Audio gain is sufficient to use with a microphone of -60 db output level or higher.

Overall stability is suitable for mobile or fixed station application.

Cabinet size is 6" x 6" x 6". Small size of the unit makes it adaptable to any type installation.

Output frequency range 3.6 to 4.0 mc., when used with a suitable VFO or crystals.

Power requirements 6.3 1.6 A., 200-300 volts, 70 to 80 M.A. D. C.

Power output up to 10 watts, depending on power supply voltage. Will drive 811As, 807s, 6146s, or most any high power tetrode or triode under AB 1 or AB 2 conditions.

In regard to the circuit theory of the X-4, a brief outline follows:

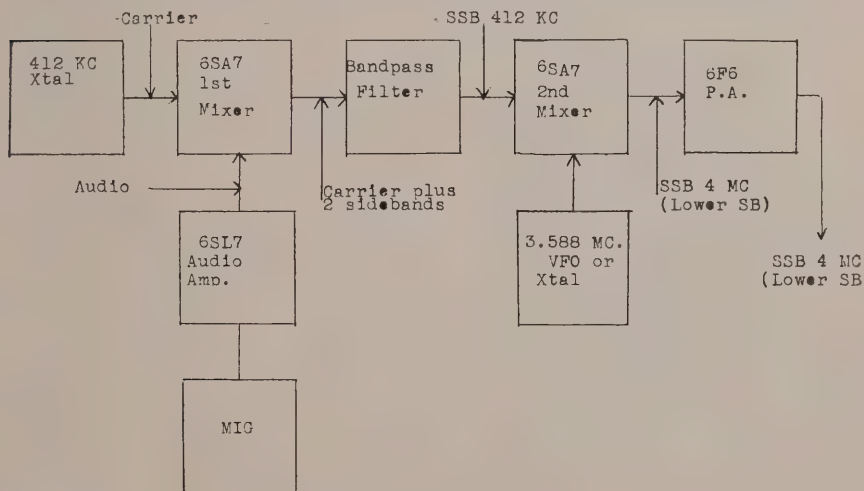
A 6SA7 serves as a combined crystal oscillator (450 KC) and audio mixer. Audio frequency voltage from the 6SL7 cascade audio voltage amplifier is injected into the signal (No. 3) grid of the 6SA7. The signal appearing at the plate of the 6SA7 first mixer is double sideband with carrier at 450 KC carrier frequency. The bandpass crystal filter, which has a band pass of 449.5 to 446.5 KC, permits only the lower sideband to pass through. Then at the terminals of the filter, there appears SSB voltage at I. F. frequency. The second 6SA7 is used as a second frequency converter to heterodyne the SSB signal frequency to 4 MC. When using crystal control or VFO for the heterodyning frequency, the No. 1 and No. 2 grid (screen grid) of the 6SA7 functions as a grid-plate oscillator. By using a crystal or tuned LC circuit (VFO) and by choosing the proper heterodyning frequency above or below the desired operating frequency, choice of transmitted sideband is afforded.

The X-4 VFO is designed to include sideband selection, by means of a switch which projects the VFO frequency above or below the operating frequency. This type of sideband selection is desirable from the standpoint of the signal characteristics being identical on either sideband.

The plate circuit of the second mixer is tuned to the operating frequency in the 4 MC. phone band. The selectivity of the tuned circuits following the second mixer eliminates the VFO frequency.

The 6F6 output tube is operated as a neutralized class AB1 linear amplifier with fixed bias. This stage serves to amplify the relatively small 4 MC. SSB signal from the 6SA7 second mixer up to a usable power level.

The X-4 operation is illustrated below in block diagram form:



Price of the X-4, wired, tested, and crystal filter aligned; \$69.50.
Kit form, \$49.50.

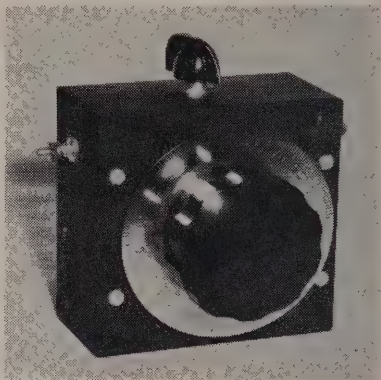
X-4 VFO

The VFO is a modified Clapp circuit, utilizing the 6SA7 second mixer in the X-4 exciter to furnish oscillator voltage.

The unit is suitable for mobile SSB application, due to the very rugged mechanical construction.

Sideband selection is provided for in the VFO.

Silver mica padders and a ceramic oscillator coil forms are used, for maximum stability.



Provides VFO operation on 20, 40, and 75 meters, when using the X-4 mixer.

There is no heat developed in the VFO cabinet, adding greatly to the stability.

A 4 inch tuning dial on the VFO unit covers 3.6 to 4.0 MC. in approximately 50 KC steps.

Cabinet size, 4" x 4" x 2", black ripple finish.

Unit requires no power, and plugs into the crystal socket on back of the X-4 exciter. 18" twin cable and plug are furnished. (Longer cable can be used.)

Price, wired and tested, \$24.50.

X-4 VOICE CONTROL UNITS

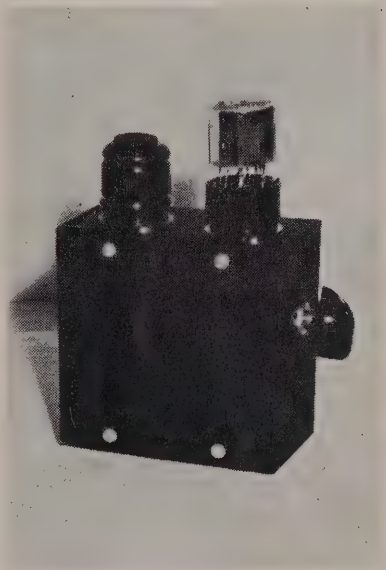
The X-4 voice control unit is designed to permit voice controlled operation of the X-4 exciter and associated receiver for fixed station use. It can also be used for mobile application if desired.

The circuit uses a 6SN7 dual triode. One triode section is used as a voltage amplifier. The second triode section is used as a negative pulse gating tube, which controls the voice operated relay.

Power requirements 6.3 V .6A, 200-300 V, 10 M.A. D. C. (can be operated from the same power supply as used for the X-4 exciter.)

The unit is housed in a 4" x 4" x 2" black ripple cabinet.

Furnished with power plug and socket, less connecting cable, wired and tested, \$19.95.



X-4 MIXER

The X-4 mixer is designed to use with the X-4 exciter to convert the 4 mc. SSB signal to 7 or 14 mc.

The circuit utilizes a 6L6 as a combined crystal oscillator and mixer stage.

To change bands using the X-4 exciter and mixer, it is only necessary to change one coil and one crystal in the mixer.

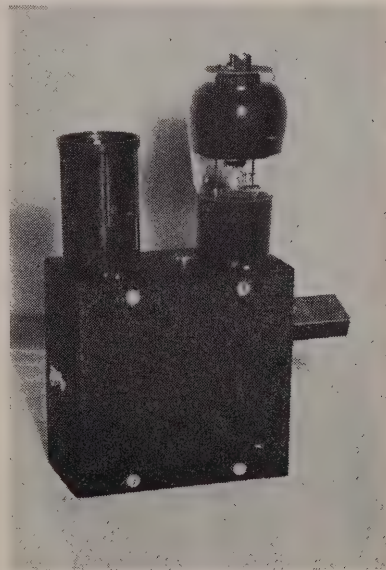
Power requirements 200-300 volts 60 M.A. D.C., 6.3. V .9A.; can be operated from the same supply as the X-4 exciter.

Power output, up to 10 watts on 40 and 20 meters.

The unit is housed in a 4" x 4" x 2" black ripple finish cabinet.

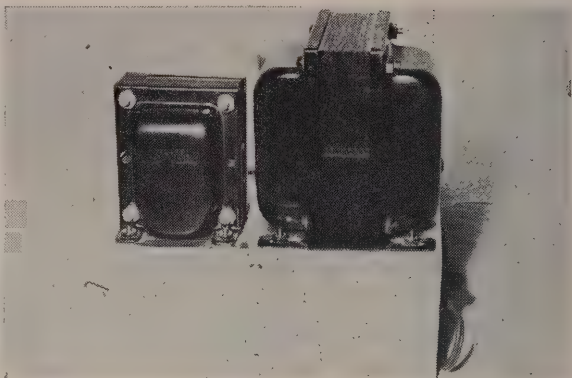
The unit is furnished with power plug and socket, less connecting cable.

Price, with coil and crystal for 20 or 40 meters, \$19.95. 20 or 40 meter crystals, \$3.95; 20 or 40 meter coil, \$1.75



X-4 POWER SUPPLY

The X-4 AC operated power supply furnishes 300 V 150 M.A. D. C., more than ample to operate the X-4 exciter complete with mixer, VFO, and voice control units. The unit also supplies 45 volts negative, for bias and muting purposes.



A total of 80 ufd filter capacity and a 10 henry choke in the H. V. supply provides hum-free operation of the equipment.

Three power output sockets, with plugs, are provided to permit individual plug-in connections for each unit.

A 4 pole 3 position switch is provided and wired into the circuit. This switch serves as a manual control switch for the X-4 exciter and the receiver in use. One set of contacts is terminated on one of the power sockets, to be used for controlling the high voltage primary relay for the high power final (if one is used). The fourth set of contacts is not wired and can be used for any switching purpose.

Price complete, mounted on 7" x 12" x 3" chassis, \$49.50.

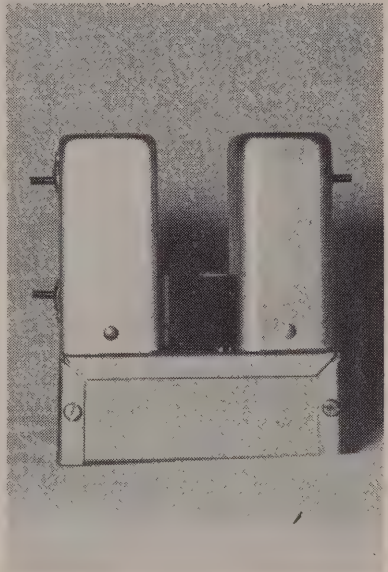
FL-1 FILTER

The FL-1 is designed for those who would like to construct a high quality crystal filter transmitter or exciter, without concern of the alignment and design of the crystal filter.

The FL-1 filter is an exact duplicate of the filter used in the SS-75 exciter. It is mounted on a small chassis 4" long, 2" wide, and 4 $\frac{3}{4}$ " high, suitable for mounting on a larger chassis.

The unit is completely aligned and ready to use by making the proper connections to the input and output terminals. The FL-1 is guaranteed to stay in alignment for **three years** from date of purchase. If the unit should fail under normal usage, within the three year period, we will repair or replace it free of charge.

Complete with carrier oscillator crystal installation notes and schematic diagram of the SS-75 exciter, \$29.50.

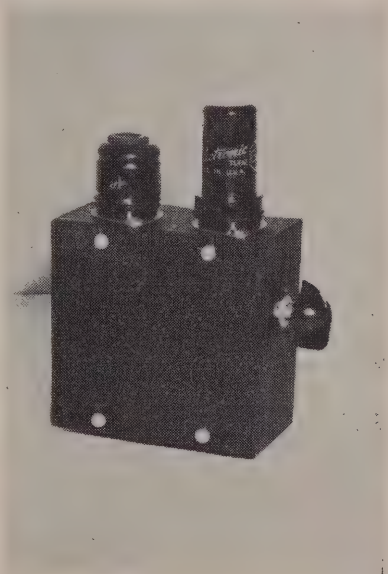


SPEAKATROL

The Speakatrol is designed to use with any voice operated relay control system. Since the microphone cannot "distinguish" sounds, a voice from the loudspeaker or a crash of static can kick the transmitter on and the receiver off.

By using the Speakatrol, the microphone can "distinguish" between sounds coming from the loudspeaker and the local operator's voice.

The unit operates by taking output voltage from the voice coil winding of the receiver output transformer. The AC voltage is stepped up, rectified to a negative DC voltage. A 6J5 is used as a negative pulse gating tube. There is a relay in the plate circuit of the 6J5. Normally with no signal from the receiver, the



tube draws plate current, holding the relay shut. As soon as a signal from the receiver induces a negative voltage on the grid of the 6J5 above a preset level, the 6J5 ceases to conduct. Then the relay opens, closing a circuit connected to the voice control in the transmitter, which disables the circuit so that no sound into the microphone can trip the transmitter on. As soon as the output from the receiver drops off, the relay closes, rendering the transmitter voice control operative.

If the unit is used with the SS-75, the exciter will furnish the necessary operating voltages.

With connecting socket and plug, less cable.

Contained in 4" x 4" x 2" black ripple cabinet, \$24.50.

TR SWITCH

The TR switch is, effectively, an electronic antenna relay. It is especially useful when fast break-in is used; such as push-to-talk AM, break-in CW, or voice control break-in such as used on single sideband.

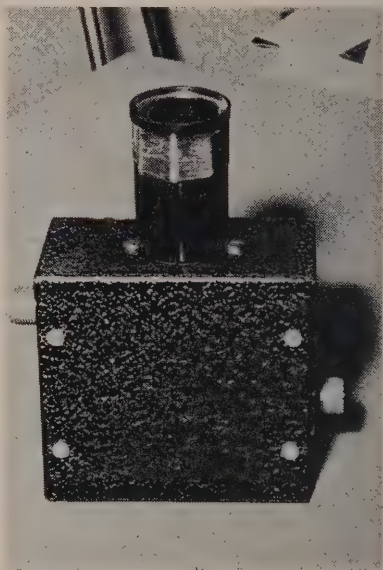
The unit does not require any external power, or connections to operate.

It will handle a KW in any class service.

The TR switch input connects directly across the coax line from the transmitting antenna. The output connects to the receiver antenna terminals. Adjust the trimmers on the TR switch for maximum received signal on the receiver S meter; that's all there is to the installation.

The TR switch uses a "limiter" or "clipper" circuit to limit the amount of power that can get from the local transmitter to the receiver; yet it allows the relatively weak received signal to pass through with little attenuation. Size 4" x 4" x 2".

Complete with 75 meter coil, \$9.95; 10, 20, 40 meter plug-in coils, \$1.75.



EQUIPMENT NOTES

The Electronic Engineering Co. pioneered the development of the first complete, manufactured, single sideband transmitter-exciter for amateur service. The unit known as the SS-75 was in production in October of 1951.

The basic design of the unit proved to be sound, from the standpoint of reliability and operating convenience. The present model of the SS-75 is essentially the same as the first units, with minor circuit and mechanical modifications.

The crystal filter method of single sideband generation was chosen because of the inherent stability characteristics of this type filter, when properly designed.

The transmission of the desirable portion of the speech spectrum for communication purposes is made possible by judicious design of the bandpass crystal filter. It has been well established that the bulk of intelligibility in the human voice lies in the spectrum of 400 c.p.s., to slightly over 3 KC. This characteristic is available in a filter type SSB generator without resort to audio frequency filters. It is desirable to confine the bandwidth of the transmitted signal to 3 KC. for several reasons:

1. To conserve space on the amateur phone bands.
2. By concentrating the transmitted power over the narrowest practical spectrum, maximum efficiency of the transmitted power is obtained.
3. The trend in modern phone communication receiver design is toward the 3 KC. square wave type selectivity; thus on a receiver of this type, anything beyond 3 KC. in the transmitted signal results in just so much wasted power.

Maximum utility of the amateur phone bands can be realized by use of receivers with 3 KC. nose selectivity and very steep skirt selectivity, and by confining the transmitted signal to 3 KC.

Perhaps one of the most desirable features of the SS-75 is variable, receiver carrier injection. This feature provides for maximum operating convenience of the SSB station. It also provides means of "on frequency" operation. "Off frequency" operation is one of the most frequent complaints heard from the serious-minded amateurs regarding SSB operation. A signal can have wonderful sideband and carrier attenuation; but if it isn't "on frequency", it sounds terrible. It would seem a logical conclusion that "on frequency" operation is a prime necessity for single sideband work. The "on frequency" operating factor was taken into consideration in the original design and development of the SS-75. By using the same oscillators that control the transmitted frequency to supply the carrier for demodulating the received SSB signal, a practical, simple "on frequency" arrangement is provided.

Bandswitching is not a built-in feature of the SS-75. There are many amateurs who do not care for SSB operation on bands other

than 75 meters, since perhaps 90% of present SSB activity is on that band. The incorporation of bandswitching would increase the selling price of the unit considerably. A bandswitching mixer is available for those who desire operation on other bands.

If reliability, ease of operation, **maintenance of carrier and side-band attenuation without adjustment**, are of prime importance to prospective purchasers, we recommend the SS-75 to fill those requirements, without parallel in the field. **To back up this statement, we guarantee the stability of the crystal filter for a period of three years from date of purchase.**

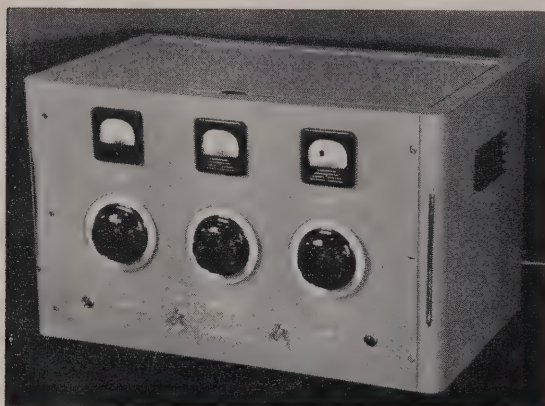
The X-4 SSB exciter was designed to fill the need of a low priced exciter in the field. The low price, compactness, and stability of the unit provides many interesting possibilities for both mobile and fixed station applications. Considerable effort was involved in developing the circuitry so that the unit would provide reliable operation.

Sideband switching is not provided in the SS-75, because with the receiver carrier injection type of operation provided in that unit, QRM dodging is accomplished in a more versatile manner with the VFO than by switching sidebands. Receiver carrier injection is not provided in the X-4; so sideband switching is incorporated in the VFO.

Prices in this catalogue are amateur net, F.O.B. Wabash, Ind., or local distributor. Prices subject to change without notice.

All equipment in this catalogue is guaranteed for a period of 90 days from date of purchase, by the manufacturer, with the exception of the filter of the SS-75, which is guaranteed for 3 years.

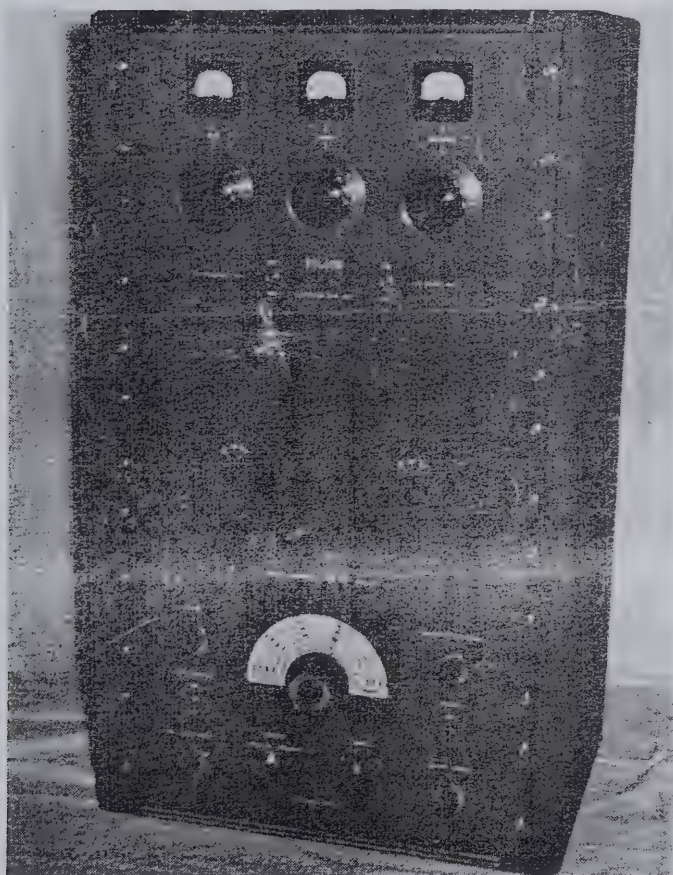
PA-400



This compact, completely self contained linear amplifier packs a real wallop on SSB. More effective than a "California Kilowatt" of AM.

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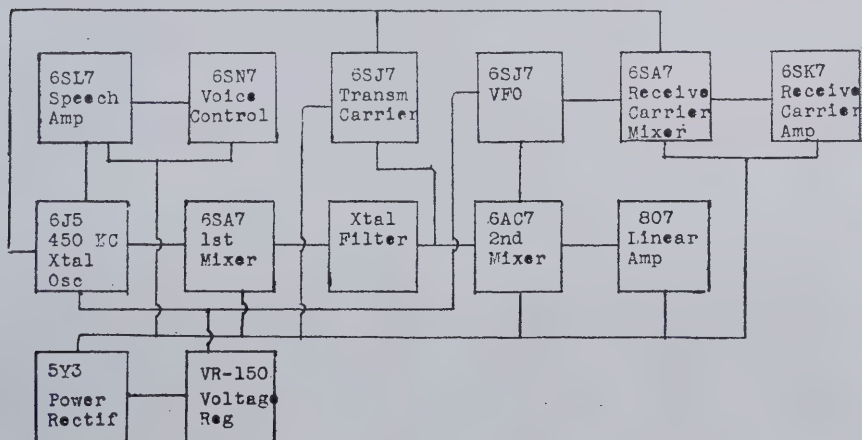
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In order to arrive at the desired operating frequency of 4 Mc, it is necessary to heterodyne the 450 KC SSSC signal with another source of carrier, so that the sum of the two frequencies add up to 4 Mc. The VFO frequency range is 3350 to 3550 in order to cover 3800 to 4000 KC with the single sideband output from the second mixer.

A 6SJ7 tube is used as a VFO in an E.C.O. circuit. Air trimmers and silver mica padders are used throughout the oscillator circuit, along with very rigid mechanical construction. The result is a VFO that is very stable.

A 6AC7 tube is used as a high gain second mixer to combine the 450 KC SSSC from the filter with the 3550 VFO frequency. The plate circuit of the second mixer is tuned to 4 Mc, as is the grid circuit of the 807. Inductive coupling is used between the plate of the second mixer and the grid of the 807. The plate circuit of the 807 output stage is a high C circuit with unbalanced low impedance variable link output coupling.

The 807, when operated class A with the exciter power supply, will provide 10 watts peak output — enough power to drive most high power tubes to a full KW. A spare wired socket is provided to accommodate another 807. Using two 807s and an external power supply (800 volts E_p , 300 Esg. regulated and minus 35 volts E_g), 100 watts peak output can be obtained.

A 6SJ7 tube is used as a 450 Kc. carrier amplifier. Its output is variable and controlled from the front panel. The output of this tube is mixed with the 3550 KC VFO frequency in the second mixer to provide 4 Mc. carrier for operating single sideband with carrier, or for tuning purposes in adjusting the loading of the linear amplifier. There is no provision for double sideband transmission, in order to keep the transmitted bandwidth of the output signal within 3 KC limits.

The 6SL7 is the audio voltage amplifier. The plate of the first section feeds the No. 3 grid of the first mixer, through a gain control on the front panel. The second section is a voltage amplifier which feeds the 6SN7 gating tube that operates the voice control relay. The threshold control for the voice operated circuit is a screwdriver slot potentiometer on the back of the chassis. The voice controlled channel is entirely independent from the modulating audio channel so that gain adjustments on either channel has no effect on the other channel.

The 6SN7 voice control tube uses one section as a voltage amplifier and the second section as a grounded cathode negative pulsed gating tube. The plate of this section is connected to a plate circuit relay with two sets of double throw contacts. One set of contacts serve to mute the exciter by keying the 6AC7 second mixer, by applying a positive bias to the cathode. The other side of the same set of contacts can be used to mute the receiver. The circuit supplies a positive bias for the RF and IF stage cathodes in the receiver. Many receivers are designed for this type muting circuit. The other set of double throw contacts can be used to control other transmitter or receiver circuits if necessary.

Break-in CW operation is provided for by means of a key jack on the rear of the chassis, and is accomplished by keying the voice control relay.

For receiver carrier injection, a 6SA7 is used as a mixer for the 450 KC crystal oscillator frequency and the 3550 VFO frequency. The plate circuit is tuned to 4 Mc. A 6SK7 is used as a receiver carrier amplifier tube. An impedance matching network is provided in the plate circuit to accommodate various receiver input impedances. The gain of these two stages is cascaded through a common gain control on the front panel of the exciter, providing over 100 db of injected carrier amplitude control.

Output frequency conversion — in order to arrive at the operating frequency of 4 Mc with the single sideband generated at 450 KC, it is necessary to heterodyne the 450 KC SSSC signal with carrier at 3550. By the same token, if 14.3 Mc output is desired from the 4 Mc exciter, it is necessary to heterodyne the 4 Mc SSSC signal to 14.3 Mc by means of a 10.3 Mc crystal oscillator. In this case VFO control over a 200 KC range is provided in the SS-75. So a crystal controlled heterodyne carrier can be used. This will permit very stable VFO operation on 14 Mc. If 10 meter operation is desired, a 24.7 Mc crystal will provide VFO controlled output on that band with the same order of stability that is obtained on 75 meters. It is necessary, of course, to have some power available on the resultant output frequency. 10 to 20 watts is generally sufficient. This amount of power can be furnished by one or two 807 tubes operating as screen modulated mixer stages.

This is the arrangement used in the **Elenco** line of Bandswitching Mixers.

The 10.3 carrier frequency from the crystal oscillator is injected to the control grid of the 807 tube. The screen of the 807 is connected to a parallel tuned circuit adjusted to 4 Mc and link coupled to the exciter output (150 regulated Esg). The plate of the 807 mixer is connected to a parallel tuned circuit adjusted to 14 Mc. This arrangement will provide 10 watts from one 807 with 600V E_p or 20 watts from two 807s in parallel.

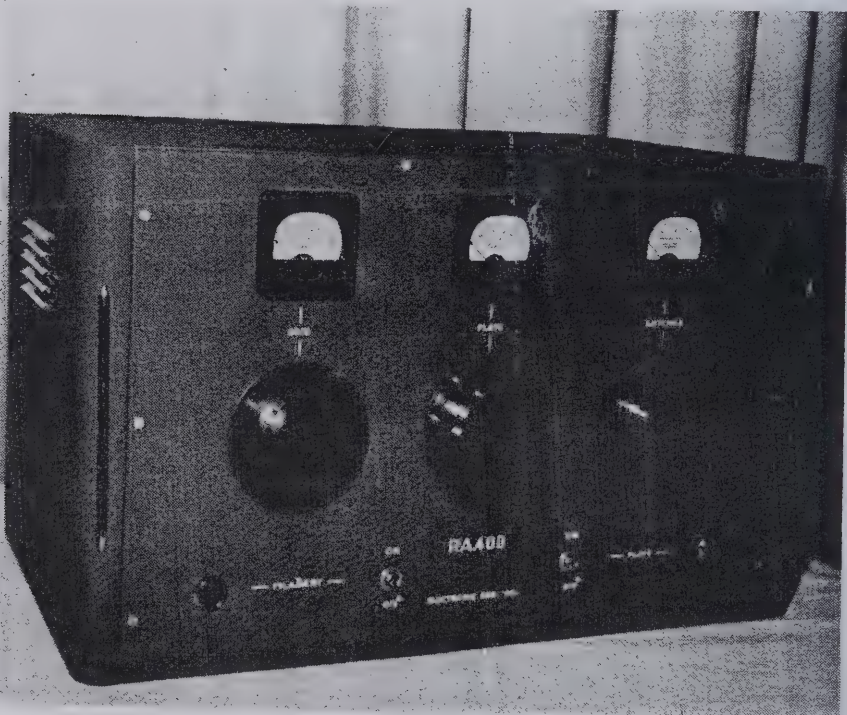
The SS-75, when used with a receiver equipped with a double lattice crystal filter or a mechanical filter, affords excellent single sideband reception, due to the carrier injection from the SS-75 and the

selectivity of the filter. Accurate S meter readings can be taken with this method on SSSC signals. Unwanted sideband observations can be made, simply by rocking the receiver dial from one side of the carrier to the other. When front end carrier injection is used, a SSSC signal tunes just like an AM signal on the receiver dial. The voice does not change pitch. Sideband attenuation readings in db. can be taken directly from the receiver S meter by this method.

PA-400 LINEAR POWER AMPLIFIER

The PA-400 utilizes a pair of 811A zero bias triodes in a cross neutralized push pull circuit.

The power supply is built-in, making the unit completely self contained, in a deluxe, gray ripple, cabinet 12" x 20" x 12". It makes a perfect companion unit for the SS-75 exciter.



The PA-400 is conservatively rated at 400 watts DC input to the 811As.

The RF input and output circuits are designed to work into an unbalanced low impedance line. Variable inductive coupling is provided in both plate and grid circuits, in order to properly adjust the

loading on the input and output circuits. The plate tank link is adjustable from the front panel.

The grid, plate, and antenna circuits are metered; thus the linear can be loaded without need for additional meters or instruments.

High capacity grid and plate circuit tanks are utilized to provide proper "Q".

75 watt plug-in coils are used in the grid circuit, and 500 watt coils are used in the plate circuit.

The PA-400 will operate 10 through 75 meters when using appropriate coils. 75 meter coils are furnished with the unit.

The PA-400 can be driven to full output with any SSB exciter delivering 6 watts or more.

Tube compliment; two 811As, two 866As.

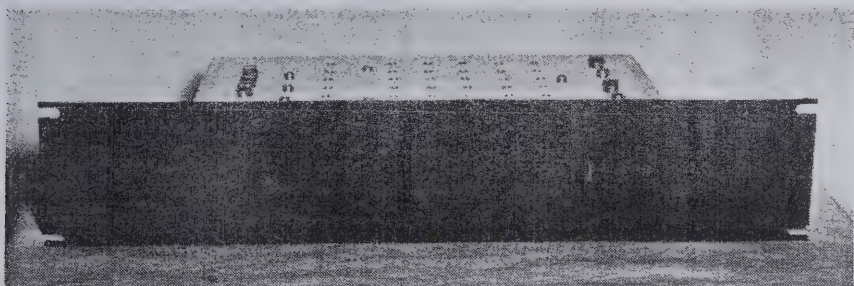
PA-400, complete with 75 meter coils, wired and tested \$265.00;
kit \$240.00.

BSM SERIES BANDSWITCHING MIXERS

The bandswitching mixer is used to convert the 4 Mc output frequency of the SS-75 to other bands.

For maximum operating convenience, the units have individual complete pretuned tank circuits for each band. This means that no retuning is required in the exciter or mixer stage when changing bands; similar to changing bands on a receiver, just turn the band-switch.

The BSM units use two 807 tubes as mixers, and a 6AG7 as the heterodyning crystal oscillator.



BSM-3

The power output is 20 watts on 20 and 40 meters, somewhat less on 10 and 15 meters, when using a 600 volt supply.

When using the SS-75 in conjunction with the BSM mixers, the units serve to convert the receiver carrier from the exciter to the desired band, as well as the transmitted SSB signal; thus serving a dual function.

Six models are provided to accommodate most any individual requirement.

On all models, when the bandswitch is on 75 meters, the mixer

power supply is automatically turned off, and the 4 MC. output from the exciter is switched straight through to the final.

All models are priced completely aligned, with all tubes and crystals; choice of black or gray panels or cabinets.

BSM-3 20, 40, 75 meters, less power supply, mounted on 3½" relay rack panel \$75.00

*BSM-4 Same as BSM-3, plus choice of 10 or 15 meter band \$100.00

BSM-3PC 20, 40, 75 meter bands, with built-in power supply, in cabinet 10" x 8" x 7" \$125.00

*BSM-4PC Same as above, plus choice of 10 or 15 meter band \$150.00

BSM-3PR Same as BSM-3PC, except mounted on 10½" rack panel \$125.00

*BSM-4PR Same as BSM-4PC, except mounted on 10½" relay rack panel \$150.00

*Will operate both 10 and 15 meters by using proper crystal.

THE X-4 SSB EXCITER

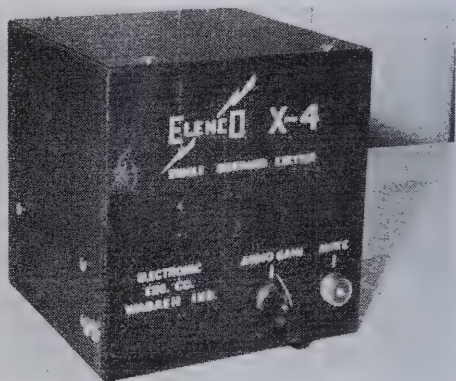
The X-4 exciter features the following tube compliment and circuitry:

6SA7 crystal oscillator and audio mixer

6SL7 speech amplifier

6SA7 second mixer and VFO

6F6 4 mc. power output



The X-4 utilizes a very stable crystal filter for sideband generation. The filter is similar to the one used in the SS-75 exciter.

Provision is made for crystal or VFO operation of the unit.

Audio gain is sufficient to use with a microphone of -60 db output level or higher.

Overall stability is suitable for mobile or fixed station application.

Cabinet size is 6" x 6" x 6". Small size of the unit makes it adaptable to any type installation.

Output frequency range 3.6 to 4.0 mc., when used with a suitable VFO or crystals.

Power requirements 6.3 1.6 A., 200-300 volts, 70 to 80 M.A. D. C.

Power output up to 10 watts, depending on power supply voltage. Will drive 811As, 807s, 6146s, or most any high power tetrode or triode under AB 1 or AB 2 conditions.

In regard to the circuit theory of the X-4, a brief outline follows:

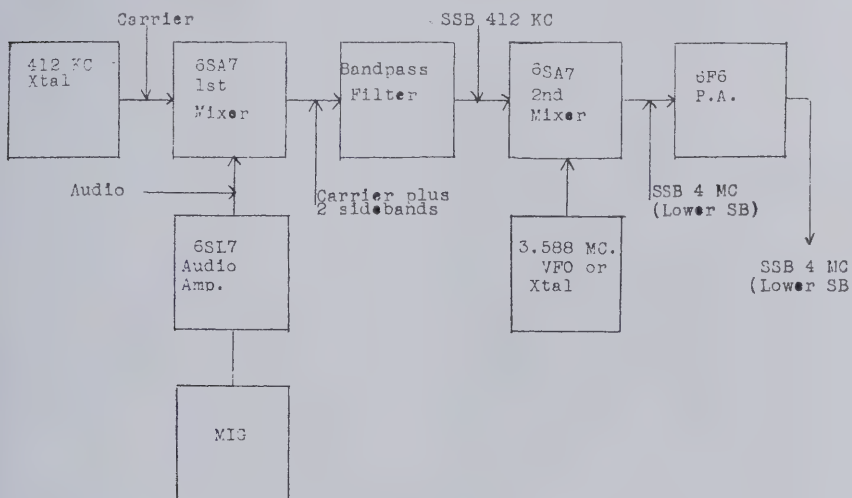
A 6SA7 serves as a combined crystal oscillator (450 KC) and audio mixer. Audio frequency voltage from the 6SL7 cascade audio voltage amplifier is injected into the signal (No. 3) grid of the 6SA7. The signal appearing at the plate of the 6SA7 first mixer is double sideband with carrier at 450 KC carrier frequency. The bandpass crystal filter, which has a band pass of 449.5 to 446.5 KC, permits only the lower sideband to pass through. Then at the terminals of the filter, there appears SSB voltage at I. F. frequency. The second 6SA7 is used as a second frequency converter to heterodyne the SSB signal frequency to 4 MC. When using crystal control or VFO for the heterodyning frequency, the No. 1 and No. 2 grid (screen grid) of the 6SA7 functions as a grid-plate oscillator. By using a crystal or tuned LC circuit (VFO) and by choosing the proper heterodyning frequency above or below the desired operating frequency, choice of transmitted sideband is afforded.

The X-4 VFO is designed to include sideband selection, by means of a switch which projects the VFO frequency above or below the operating frequency. This type of sideband selection is desirable from the standpoint of the signal characteristics being identical on either sideband.

The plate circuit of the second mixer is tuned to the operating frequency in the 4 MC. phone band. The selectivity of the tuned circuits following the second mixer eliminates the VFO frequency.

The 6F6 output tube is operated as a neutralized class AB1 linear amplifier with fixed bias. This stage serves to amplify the relatively small 4 MC. SSB signal from the 6SA7 second mixer up to a usable power level.

The X-4 operation is illustrated below in block diagram form:



Price of the X-4, wired, tested, and crystal filter aligned; \$69.50.
Kit form, \$49.50.

X-4 VFO

The VFO is a modified Clapp circuit, utilizing the 6SA7 second mixer in the X-4 exciter to furnish oscillator voltage.

The unit is suitable for mobile SSB application, due to the very rugged mechanical construction.

Sideband selection is provided for in the VFO.

Silver mica padders and a ceramic oscillator coil forms are used, for maximum stability.

Provides VFO operation on 20, 40, and 75 meters, when using the X-4 mixer.

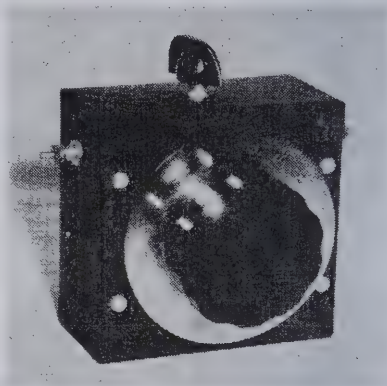
There is no heat developed in the VFO cabinet, adding greatly to the stability.

A 4 inch tuning dial on the VFO unit covers 3.6 to 4.0 MC. in approximately 50 KC steps.

Cabinet size, 4" x 4" x 2", black ripple finish.

Unit requires no power, and plugs into the crystal socket on back of the X-4 exciter. 18" twin cable and plug are furnished. (Longer cable can be used.)

Price, wired and tested, \$24.50.



X-4 VOICE CONTROL UNITS

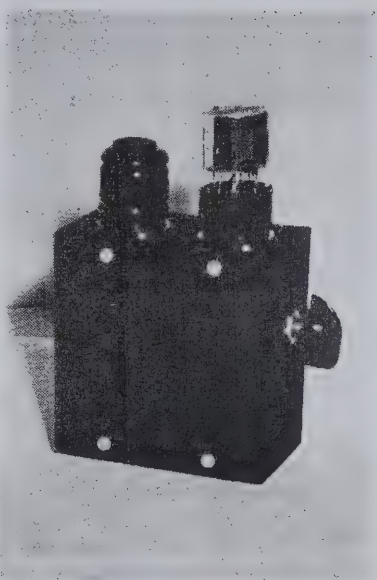
The X-4 voice control unit is designed to permit voice controlled operation of the X-4 exciter and associated receiver for fixed station use. It can also be used for mobile application if desired.

The circuit uses a 6SN7 dual triode. One triode section is used as a voltage amplifier. The second triode section is used as a negative pulse gating tube, which controls the voice operated relay.

Power requirements 6.3 V .6A, 200-300 V, 10 M.A. D. C. (can be operated from the same power supply as used for the X-4 exciter.)

The unit is housed in a 4" x 4" x 2" black ripple cabinet.

Furnished with power plug and socket, less connecting cable, wired and tested, \$19.95.



X-4 MIXER

The X-4 mixer is designed to use with the X-4 exciter to convert the 4 mc. SSB signal to 7 or 14 mc.

The circuit utilizes a 6L6 as a combined crystal oscillator and mixer stage.

To change bands using the X-4 exciter and mixer, it is only necessary to change one coil and one crystal in the mixer.

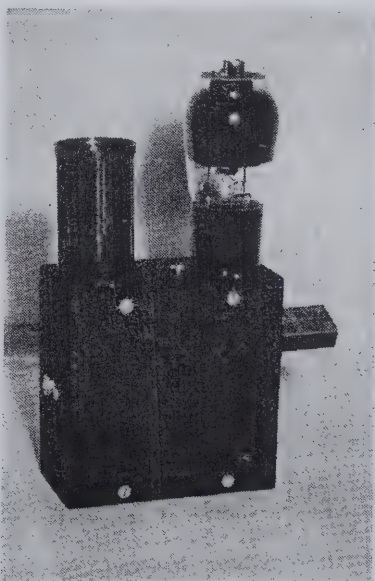
Power requirements 200-300 volts 60 M.A. D.C., 6.3 V .9A.; can be operated from the same supply as the X-4 exciter.

Power output, up to 10 watts on 40 and 20 meters.

The unit is housed in a 4" x 4" x 2" black ripple finish cabinet.

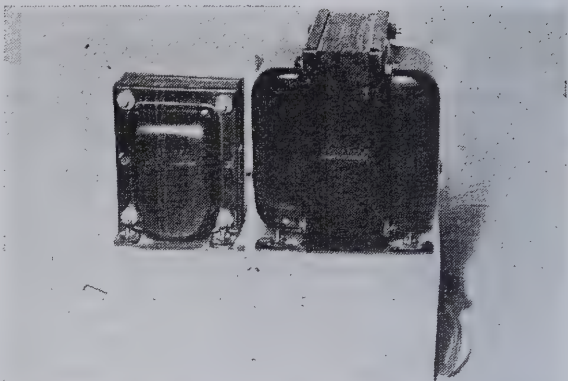
The unit is furnished with power plug and socket, less connecting cable.

Price, with coil and crystal for 20 or 40 meters, \$19.95. 20 or 40 meter crystals, \$3.95; 20 or 40 meter coil, \$1.75



X-4 POWER SUPPLY

The X-4 AC operated power supply furnishes 300 V 150 M.A. D. C., more than ample to operate the X-4 exciter complete with mixer, VFO, and voice control units. The unit also supplies 45 volts negative, for bias and muting purposes.



A total of 80 ufd filter capacity and a 10 henry choke in the H. V. supply provides hum-free operation of the equipment.

Three power output sockets, with plugs, are provided to permit individual plug-in connections for each unit.

A 4 pole 3 position switch is provided and wired into the circuit. This switch serves as a manual control switch for the X-4 exciter and the receiver in use. One set of contacts is terminated on one of the power sockets, to be used for controlling the high voltage primary relay for the high power final (if one is used). The fourth set of contacts is not wired and can be used for any switching purpose.

Price complete, mounted on 7" x 12" x 3" chassis, \$49.50.

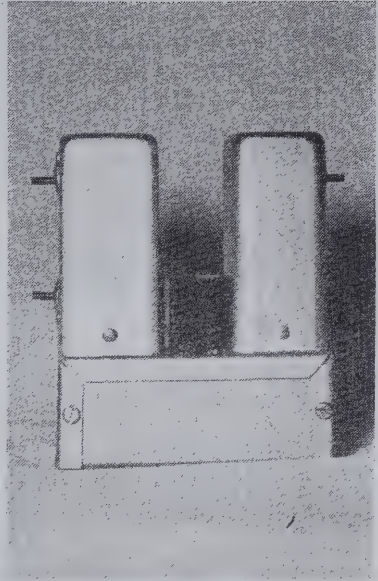
FL-1 FILTER

The FL-1 is designed for those who would like to construct a high quality crystal filter transmitter or exciter, without concern of the alignment and design of the crystal filter.

The FL-1 filter is an exact duplicate of the filter used in the SS-75 exciter. It is mounted on a small chassis 4" long, 2" wide, and 4 $\frac{3}{4}$ " high, suitable for mounting on a larger chassis.

The unit is completely aligned and ready to use by making the proper connections to the input and output terminals. The FL-1 is guaranteed to stay in alignment for **three years** from date of purchase. If the unit should fail under normal usage, within the three year period, we will repair or replace it free of charge.

Complete with carrier oscillator crystal installation notes and schematic diagram of the SS-75 exciter, \$29.50.

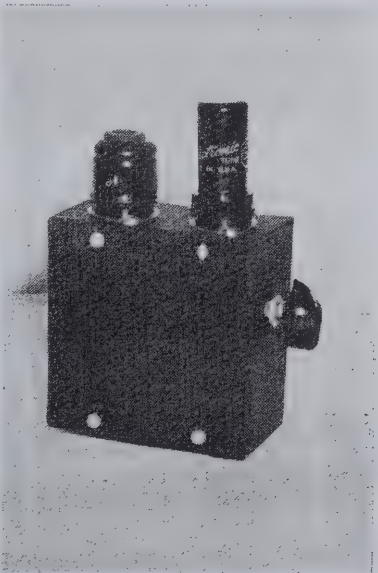


SPEAKATROL

The Speakatrol is designed to use with any voice operated relay control system. Since the microphone cannot "distinguish" sounds, a voice from the loudspeaker or a crash of static can kick the transmitter on and the receiver off.

By using the Speakatrol, the microphone can "distinguish" between sounds coming from the loudspeaker and the local operator's voice.

The unit operates by taking output voltage from the voice coil winding of the receiver output transformer. The AC voltage is stepped up, rectified to a negative DC voltage. A 6J5 is used as a negative pulse gating tube. There is a relay in the plate circuit of the 6J5. Normally with no signal from the receiver, the



tube draws plate current, holding the relay shut. As soon as a signal from the receiver induces a negative voltage on the grid of the 6J5 above a preset level, the 6J5 ceases to conduct. Then the relay opens, closing a circuit connected to the voice control in the transmitter, which disables the circuit so that no sound into the microphone can trip the transmitter on. As soon as the output from the receiver drops off, the relay closes, rendering the transmitter voice control operative.

If the unit is used with the SS-75, the exciter will furnish the necessary operating voltages.

With connecting socket and plug, less cable.

Contained in 4" x 4" x 2" black ripple cabinet, \$24.50.

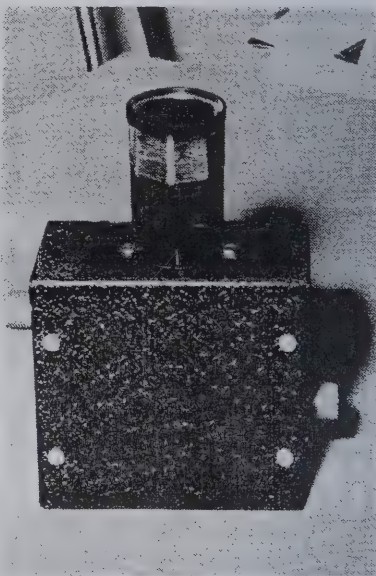
TR SWITCH

The TR switch is, effectively, an electronic antenna relay. It is especially useful when fast break-in is used; such as push-to-talk AM, break-in CW, or voice control break-in such as used on single sideband.

The unit does not require any external power, or connections to operate.

It will handle a KW in any class service.

The TR switch input connects directly across the coax line from the transmitting antenna. The output connects to the receiver antenna terminals. Adjust the trimmers on the TR switch for maximum received signal on the receiver S meter; that's all there is to the installation.



The TR switch uses a "limiter" or "clipper" circuit to limit the amount of power that can get from the local transmitter to the receiver; yet it allows the relatively weak received signal to pass through with little attenuation. Size 4" x 4" x 2".

Complete with 75 meter coil, \$9.95; 10, 20, 40 meter plug-in coils, \$1.75.

EQUIPMENT NOTES

The Electronic Engineering Co. pioneered the development of the first complete, manufactured, single sideband transmitter-exciter for amateur service. The unit known as the SS-75 was in production in October of 1951.

The basic design of the unit proved to be sound, from the standpoint of reliability and operating convenience. The present model of the SS-75 is essentially the same as the first units, with minor circuit and mechanical modifications.

The crystal filter method of single sideband generation was chosen because of the inherent stability characteristics of this type filter, when properly designed.

The transmission of the desirable portion of the speech spectrum for communication purposes is made possible by judicious design of the bandpass crystal filter. It has been well established that the bulk of intelligibility in the human voice lies in the spectrum of 400 c.p.s., to slightly over 3 KC. This characteristic is available in a filter type SSB generator without resort to audio frequency filters. It is desirable to confine the bandwidth of the transmitted signal to 3 KC. for several reasons:

1. To conserve space on the amateur phone bands.
2. By concentrating the transmitted power over the narrowest practical spectrum, maximum efficiency of the transmitted power is obtained.
3. The trend in modern phone communication receiver design is toward the 3 KC. square wave type selectivity; thus on a receiver of this type, anything beyond 3 KC. in the transmitted signal results in just so much wasted power.

Maximum utility of the amateur phone bands can be realized by use of receivers with 3 KC. nose selectivity and very steep skirt selectivity, and by confining the transmitted signal to 3 KC.

Perhaps one of the most desirable features of the SS-75 is variable, receiver carrier injection. This feature provides for maximum operating convenience of the SSB station. It also provides means of "on frequency" operation. "Off frequency" operation is one of the most frequent complaints heard from the serious-minded amateurs regarding SSB operation. A signal can have wonderful sideband and carrier attenuation; but if it isn't "on frequency", it sounds terrible. It would seem a logical conclusion that "on frequency" operation is a prime necessity for single sideband work. The "on frequency" operating factor was taken into consideration in the original design and development of the SS-75. By using the same oscillators that control the transmitted frequency to supply the carrier for demodulating the received SSB signal, a practical, simple "on frequency" arrangement is provided.

Bandswitching is not a built-in feature of the SS-75. There are many amateurs who do not care for SSB operation on bands other

than 75 meters, since perhaps 90% of present SSB activity is on that band. The incorporation of bandswitching would increase the selling price of the unit considerably. A bandswitching mixer is available for those who desire operation on other bands.

If reliability, ease of operation, **maintenance of carrier and sideband attenuation without adjustment**, are of prime importance to prospective purchasers, we recommend the SS-75 to fill those requirements, without parallel in the field. **To back up this statement, we guarantee the stability of the crystal filter for a period of three years from date of purchase.**

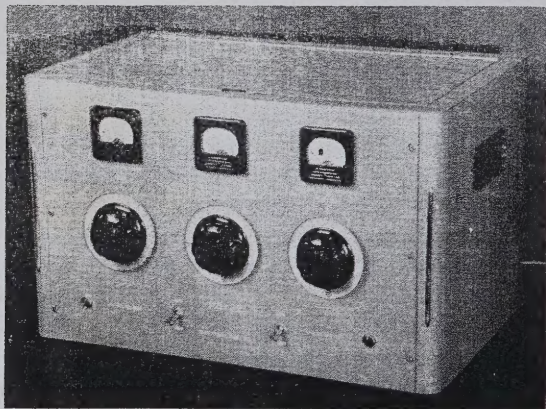
The X-4 SSB exciter was designed to fill the need of a low priced exciter in the field. The low price, compactness, and stability of the unit provides many interesting possibilities for both mobile and fixed station applications. Considerable effort was involved in developing the circuitry so that the unit would provide reliable operation.

Sideband switching is not provided in the SS-75, because with the receiver carrier injection type of operation provided in that unit, QRM dodging is accomplished in a more versatile manner with the VFO than by switching sidebands. Receiver carrier injection is not provided in the X-4; so sideband switching is incorporated in the VFO.

Prices in this catalogue are amateur net, F.O.B. Wabash, Ind., or local distributor. Prices subject to change without notice.

All equipment in this catalogue is guaranteed for a period of 90 days from date of purchase, by the manufacturer, with the exception of the filter of the SS-75, which is guaranteed for 3 years.

PA-400



This compact, completely self contained linear amplifier packs a real wallop on SSB. More effective than a "California Kilowatt" of AM.

